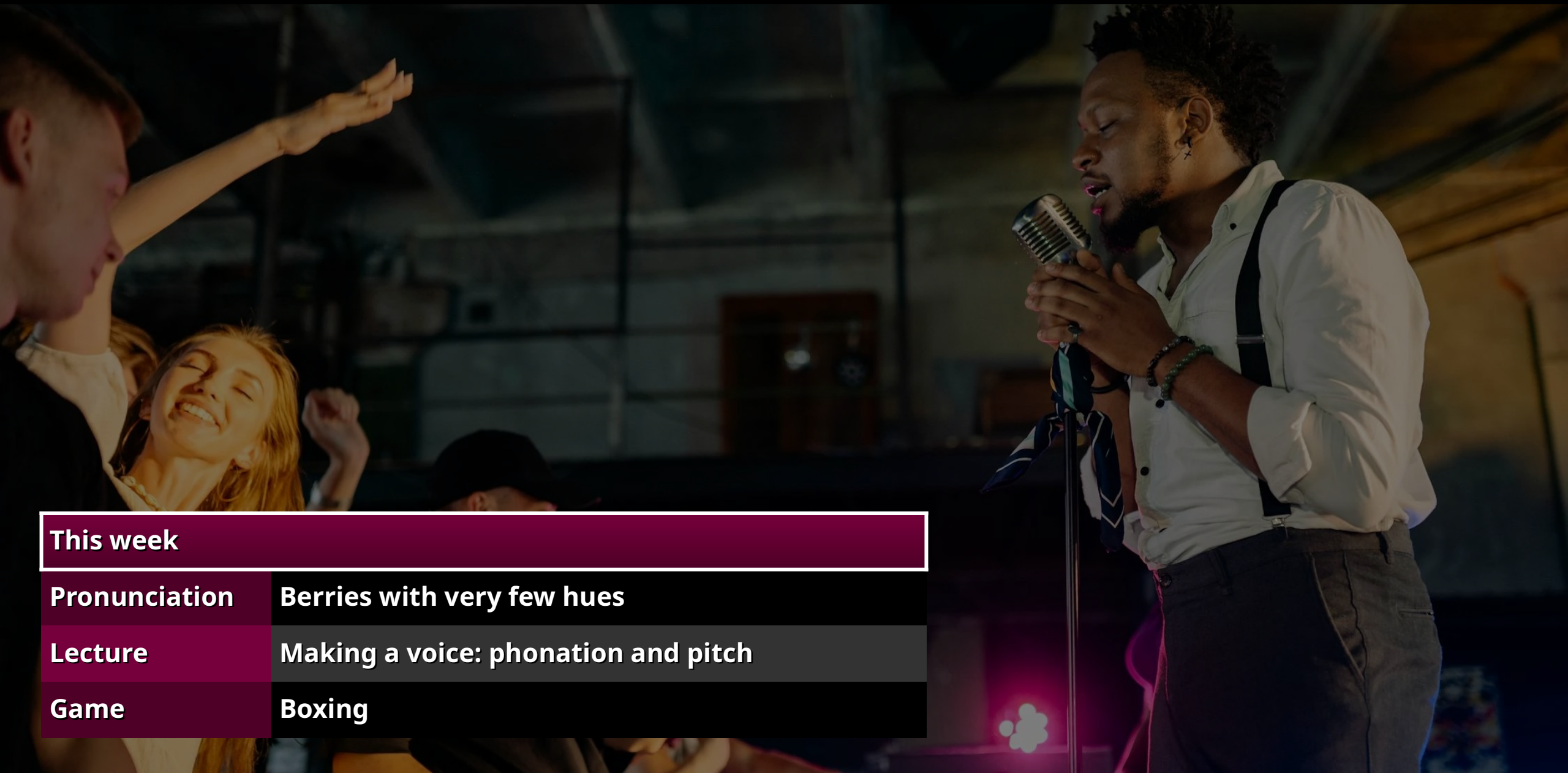


# English Phonetics 04: Making a Voice



# English Phonetics 04: Making a Voice



## This week

<b>Pronunciation</b>	<b>Berries with very few hues</b>
<b>Lecture</b>	<b>Making a voice: phonation and pitch</b>
<b>Game</b>	<b>Boxing</b>

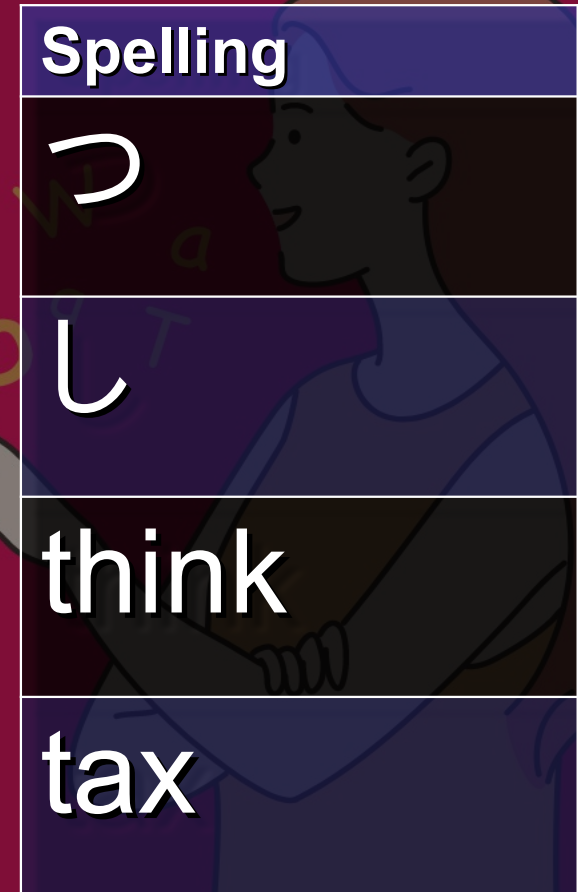
**Here!**



# Lecture: The International Phonetic Alphabet

## Segments, phonemes, phones

- ★ Each letter in IPA is a segment (分節音)
- ★ The smallest sound we can pronounce
- ★ Consonants (子音) and vowels (母音)

A woman with dark hair, wearing a blue top, is pointing her right index finger towards the table. The background behind her is a dark blue silhouette of a person's head and shoulders.

Spelling	IPA
ツ	/tsu/
シ	/çi/
think	/θɪŋk/
tax	/tæks/



# Lecture: The International Phonetic Alphabet

## Differences from Genius

- ★ Most dictionaries have their own system
- ★ Most linguists think this is stupid

Word	IPA	Genius
kiss	ɪ	ɪ
dress	ɛ	e
cat	æ	æ
foot	ʊ	U
cup	ə	ʌ
hot	ɑ	ɑː

Word	IPA	Genius
sleep	ij	iː
face	ej	eɪ
school	uw	uː
boat	ow	ou
price	aj	aɪ
choice	oj	ɔɪ
mouth	aw	au

Word	IPA	Genius
bird	ə	əːr
start	ɑr	ɑːr
north	or	ɔːr
near	ir	ɪər
cure	ur	uər
square	er	eər

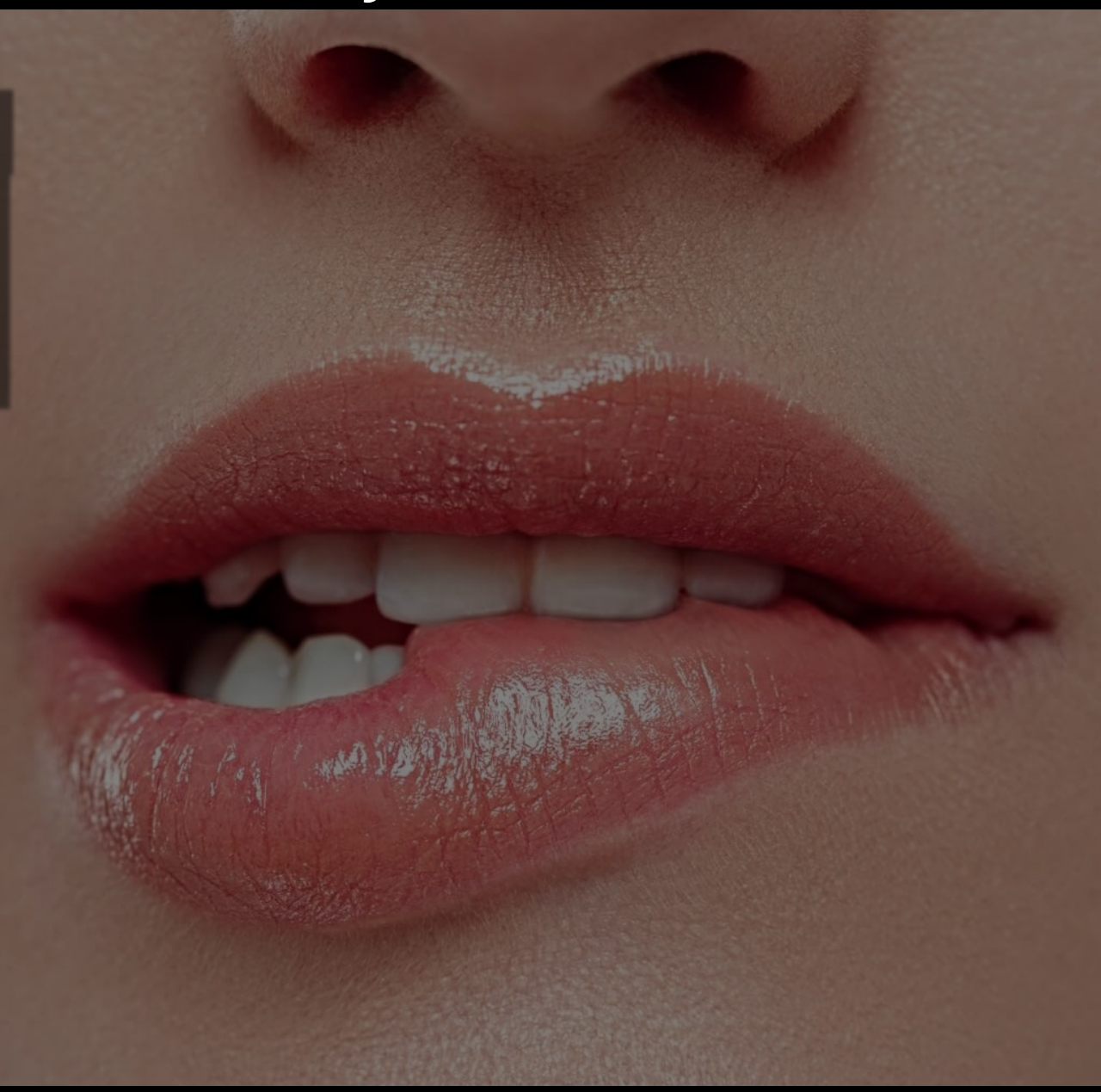
**Pronunciation: Berries with very few hues**



# Pronunciation: Berries with very few hues

## Overview

- ★ [f] and [h]
- ★ [b] and [v]
- ★ minimal pairs



# Pronunciation: Berries with very few hues

## [f] and [h]

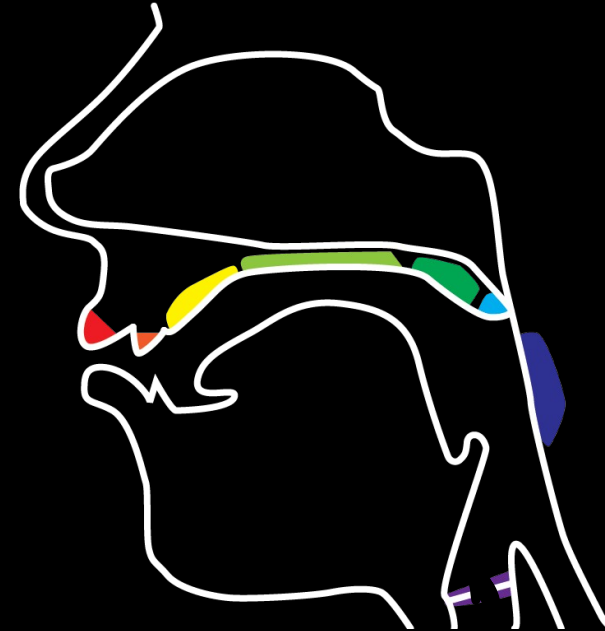
- ★ [f] = voiceless labiodental fricative ( 無声唇齒摩擦音 )
- ★ [h] = voiceless glottal fricative ( 無声声門摩擦音 )
- ★ Japanese [ϕ] = voiceless bilabial fricative ( 無声兩唇摩擦音 )



[f]



[h]



[ϕ]

# Pronunciation: Berries with very few hues

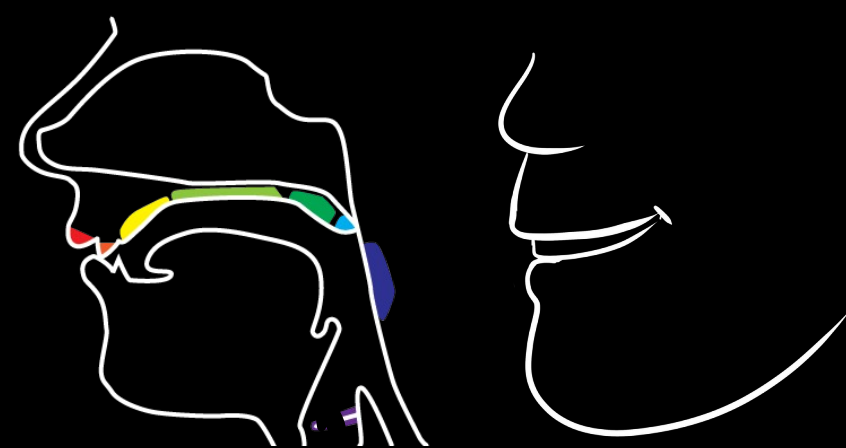
No need to bite deep

- ★ Use the inside of the lip
- ★ A deep bite is too slow



# Pronunciation: Berries with very few hues

Try saying Japanese っ words with an American accent.  
Now try English words: fish [fɪʃ], fly [flaɪ]



福岡

[,fuw,ku'wowkə]



洋服

['jowfə,kuw]



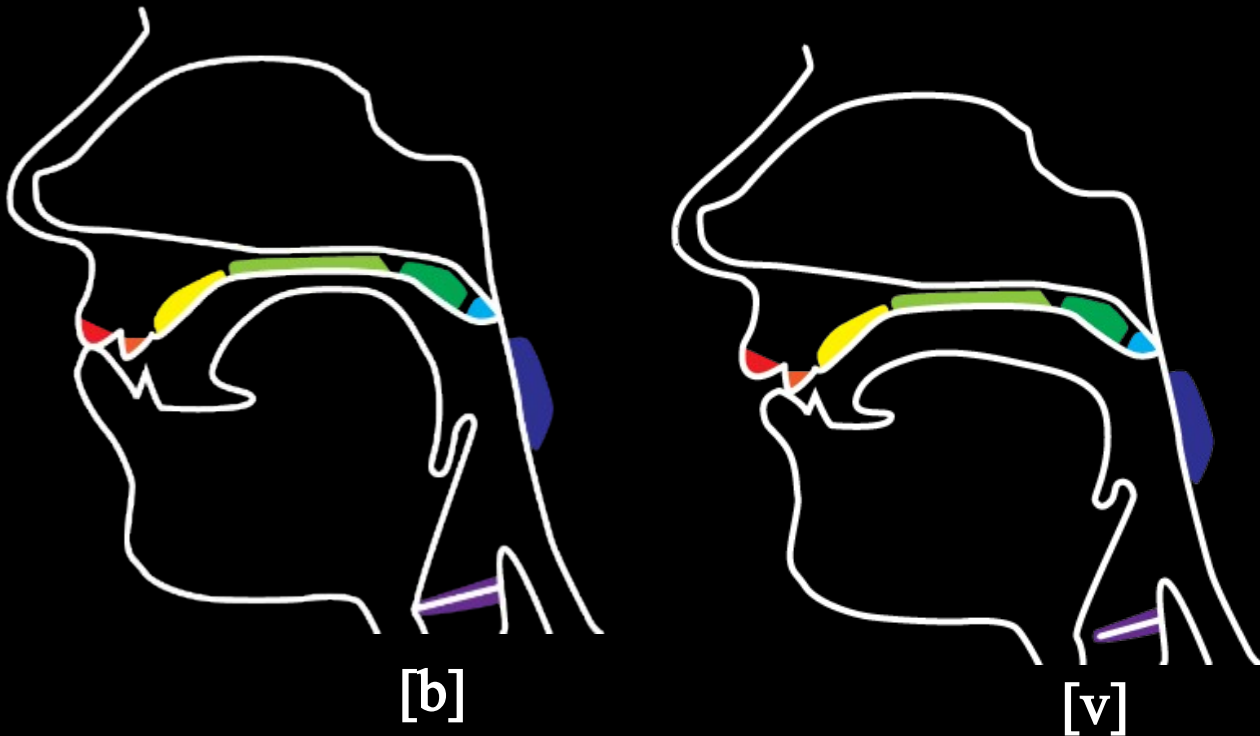
flying fish

[,flaɪɪŋ 'fɪʃ]

# Pronunciation: Berries with very few hues

## [b] and [v]

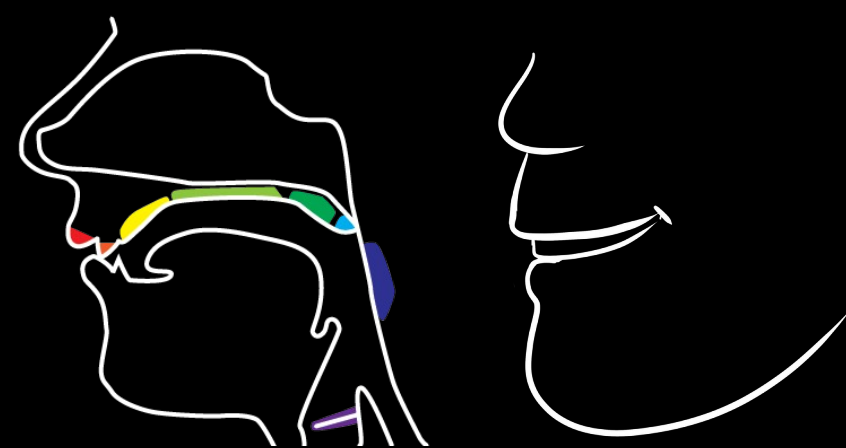
- ★ [b] = voiced bilabial fricative ( 有声両唇破裂音 )
- ★ [v] = voiced labiodental fricative ( 有声唇齒摩擦音 )



Dacci, リチャード川口 (2019) 「発音記号キャラ辞典」 角川

# Pronunciation: Berries with very few hues

Try saying Japanese /b/ words with an American accent.



危ない  
[ævə'naj]



美術館  
[vɪ'dzuwtsə,kan]



average vanilla  
[ævɪdʒ və'nɪlə]

# Pronunciation: Berries with very few hues



few

hue

fool

who'll

[fjuw]

[hjuw]

[fuw<sup>ə</sup>ɫ]

[huw<sup>ə</sup>ɫ]

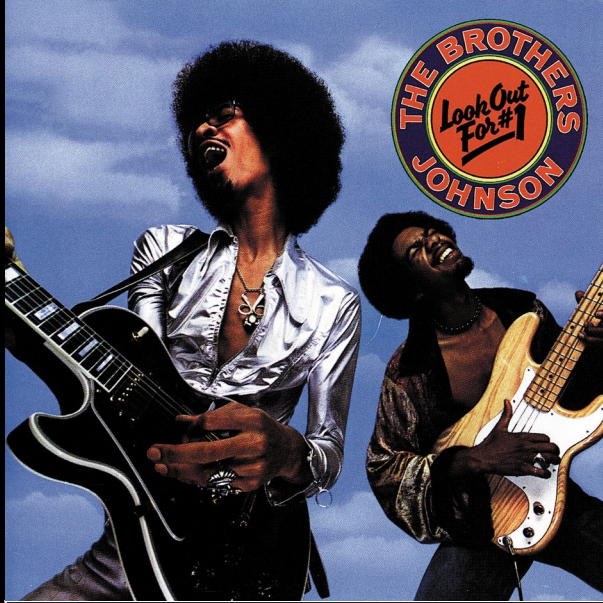
少ない、いくつかの

色相

間抜け

誰が～する(未来形)

# Pronunciation: Berries with very few hues



funky

hunky

four

whore

[ˈfʌŋki]

[ˈhʌŋki]

[fɔr]

[hɔr]

ファンキーな

筋肉質でセクシーな

四

売春婦、ふしだらな女

super disrespectful,  
don't say this

# Pronunciation: Berries with very few hues



base

vase

boat

vote

[bejs]

[vejs]

[bowt]

[vowt]

基盤、駐屯地、塁

花瓶、つぼ

船

投票する

# Pronunciation: Berries with very few hues



bury

very

bow

vow

[<sup>1</sup>'berij]

[<sup>1</sup>'verij]

[baw]

[vaw]

埋める

とても

お辞儀

誓い

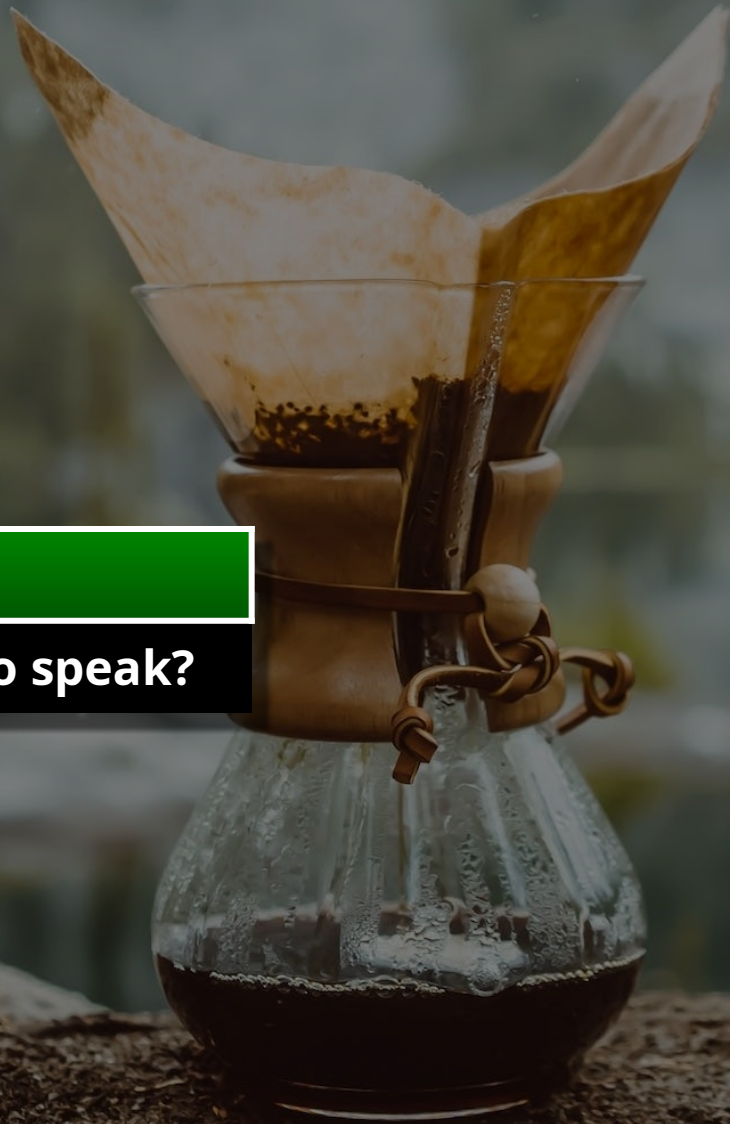
# Lecture: The Source-Filter Model



# Lecture: The Source-Filter Model

## Discussion question

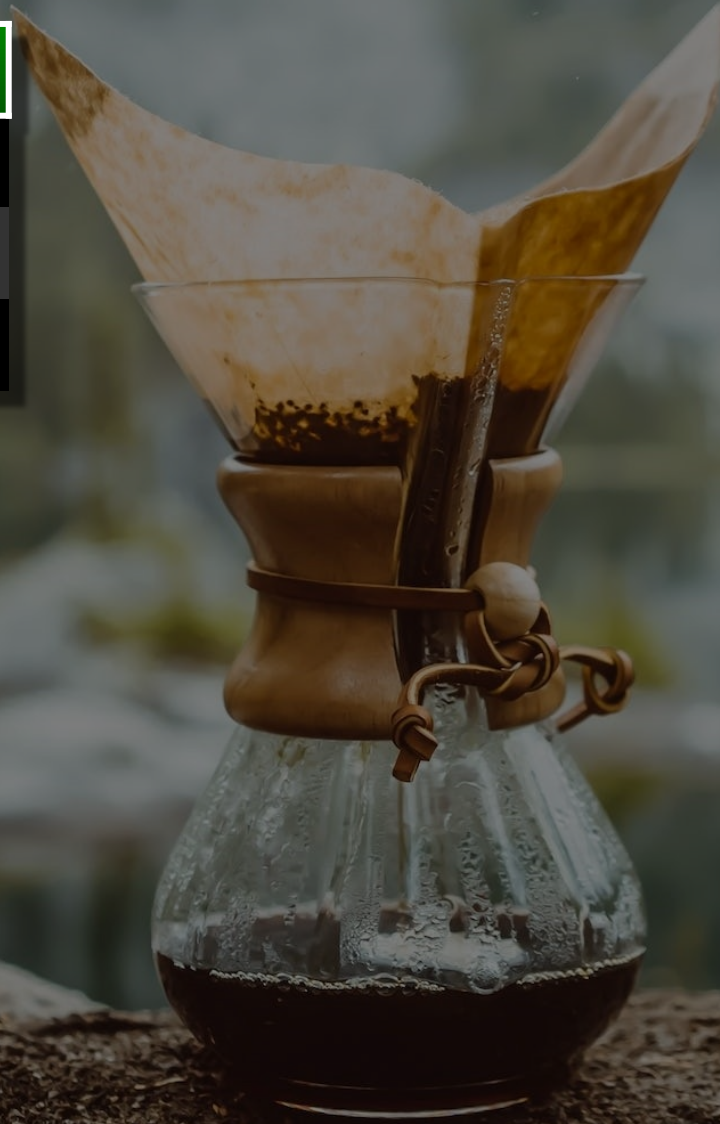
- ★ What do we need, physically, to speak?



# Lecture: The Source-Filter Model

## Overview

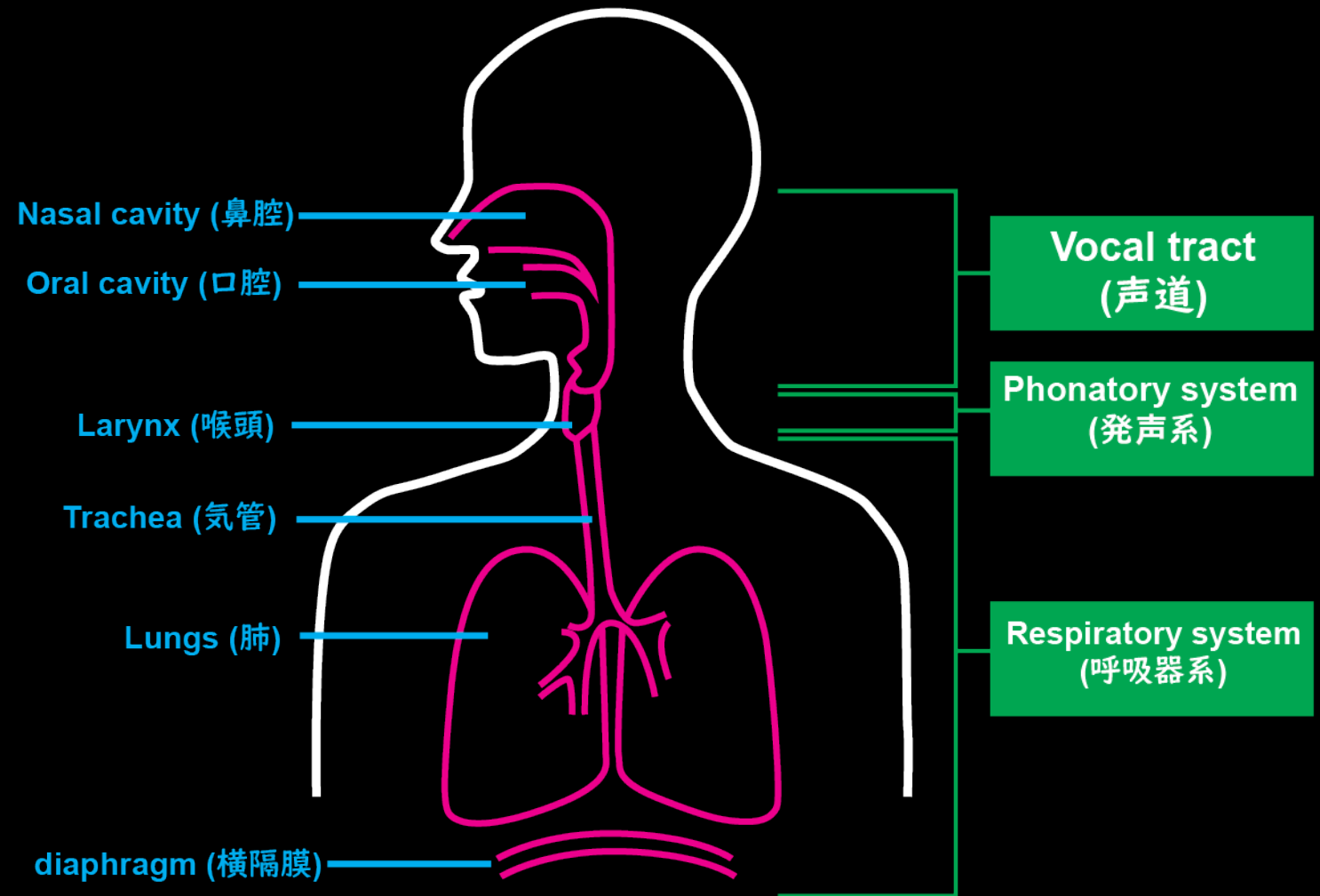
- ★ Key anatomy
- ★ Pitch and frequency
- ★ Singing voices



# Lecture: The Source-Filter Model

## Key anatomy

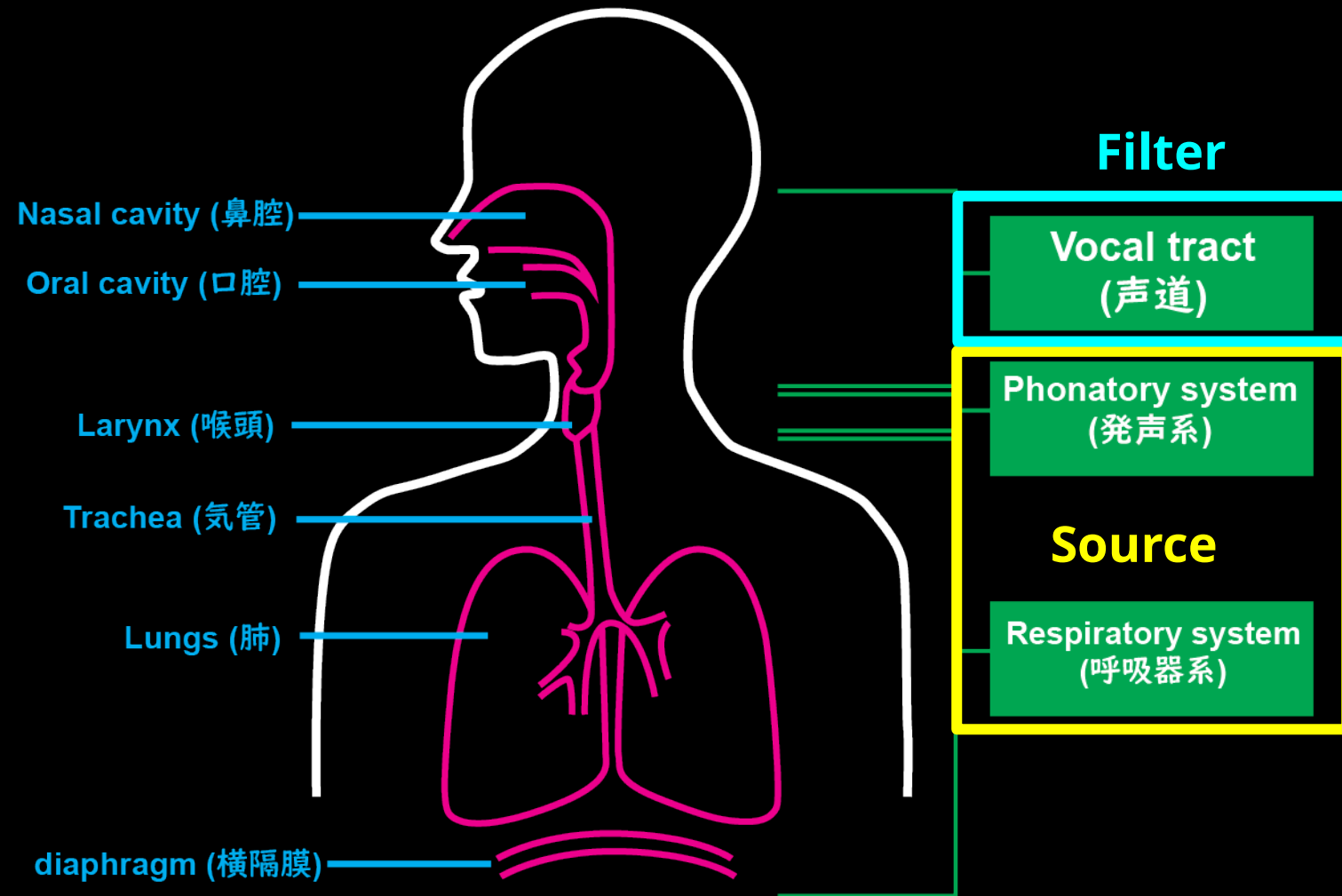
- ★ The respiratory system
- ★ The larynx
- ★ The vocal tract



# Lecture: The Source-Filter Model

## Key anatomy

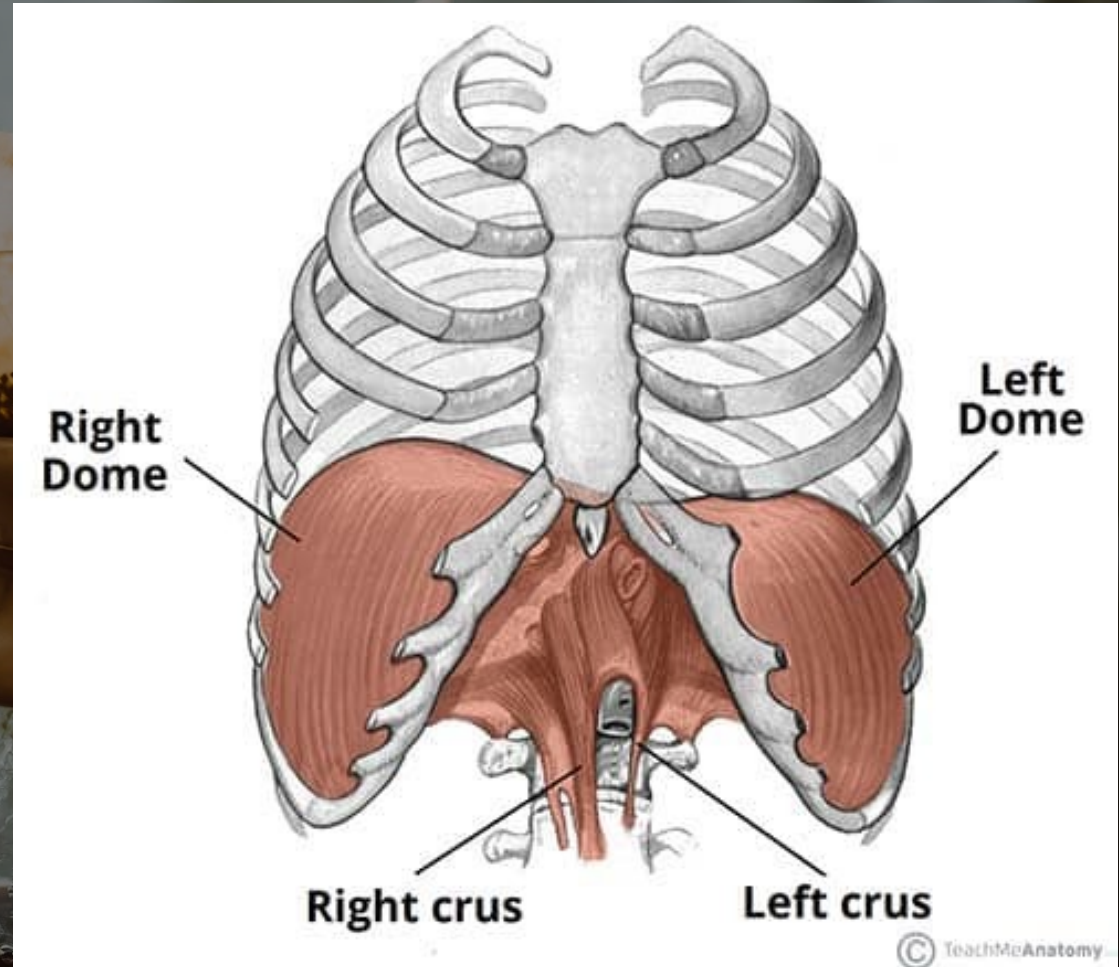
- ★ The respiratory system
- ★ The larynx
- ★ The vocal tract



# Lecture: The Source-Filter Model

## The respiratory system

- ☆ **diaphragm** (横隔膜) おうかくまく
- ☆ creates a vacuum in the lungs to breathe in
- ☆ pushes air out of the lungs, up the trachea, and into the larynx



<https://teachmeanatomy.info/thorax/muscles/diaphragm/>

# Lecture: The Source-Filter Model

## The respiratory system

- ★ **diaphragm** ( 横隔膜 )  
おうかくまく
- ★ creates a vacuum in the lungs to breathe in
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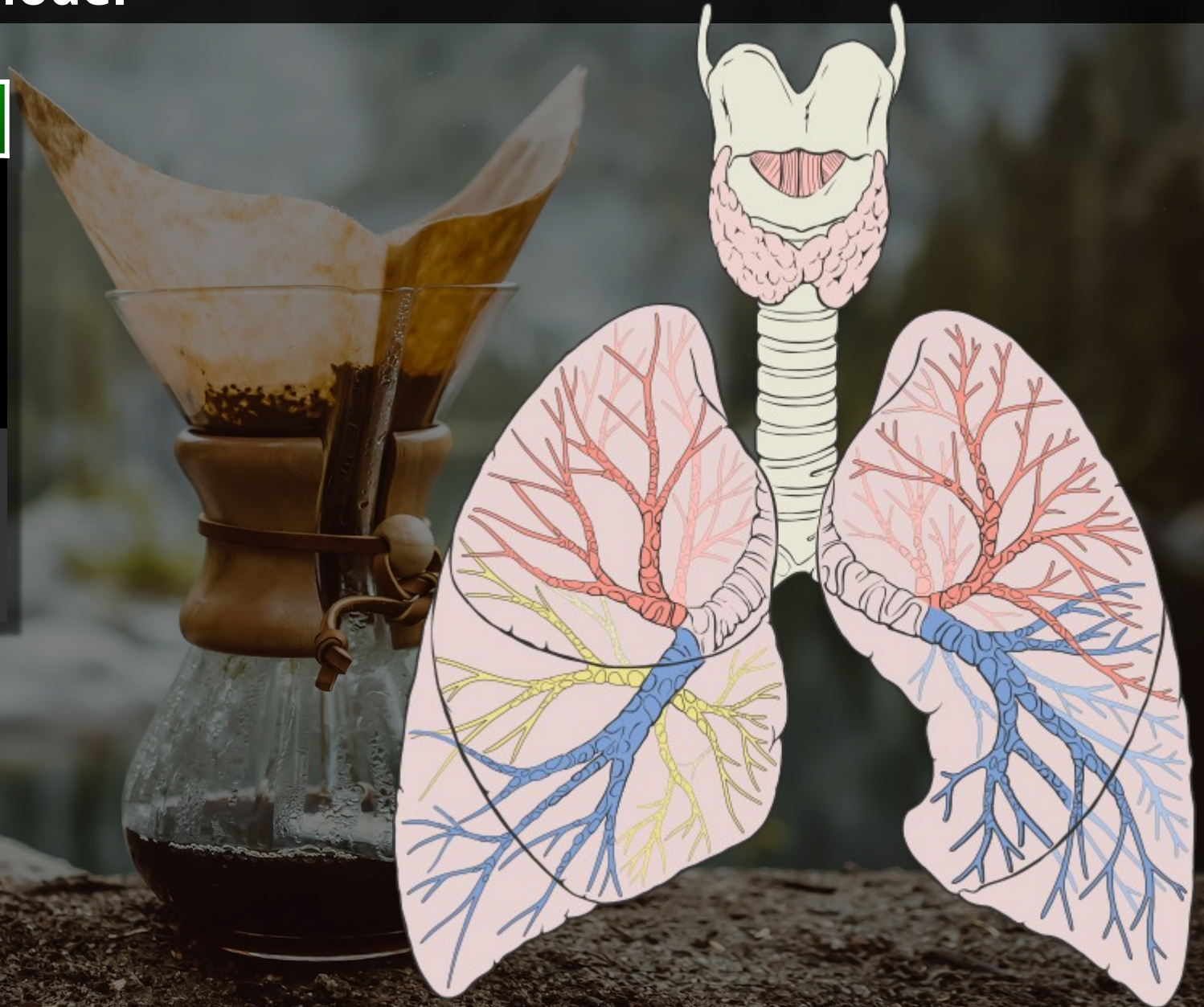
Arai Takayuki (Sophia University)

# Lecture: The Source-Filter Model

## The respiratory system

- ★ きかん  
trachea ( 気管 )  
also called the "airway"  
air passage

- ★ はい  
lungs ( 肺 )  
air storage



# Lecture: The Source-Filter Model

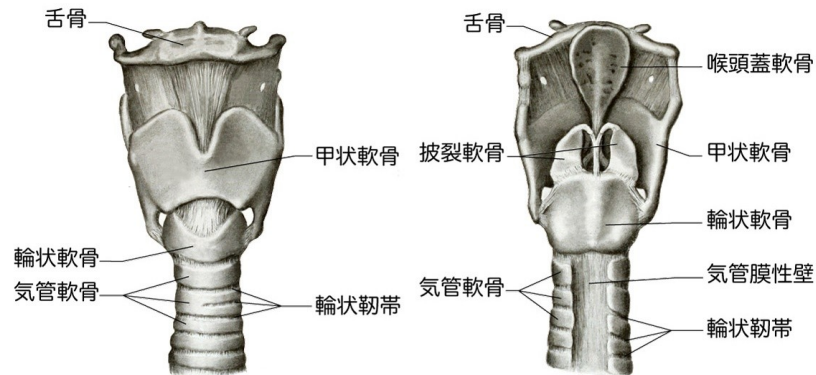
## The phonatory system

こうとう

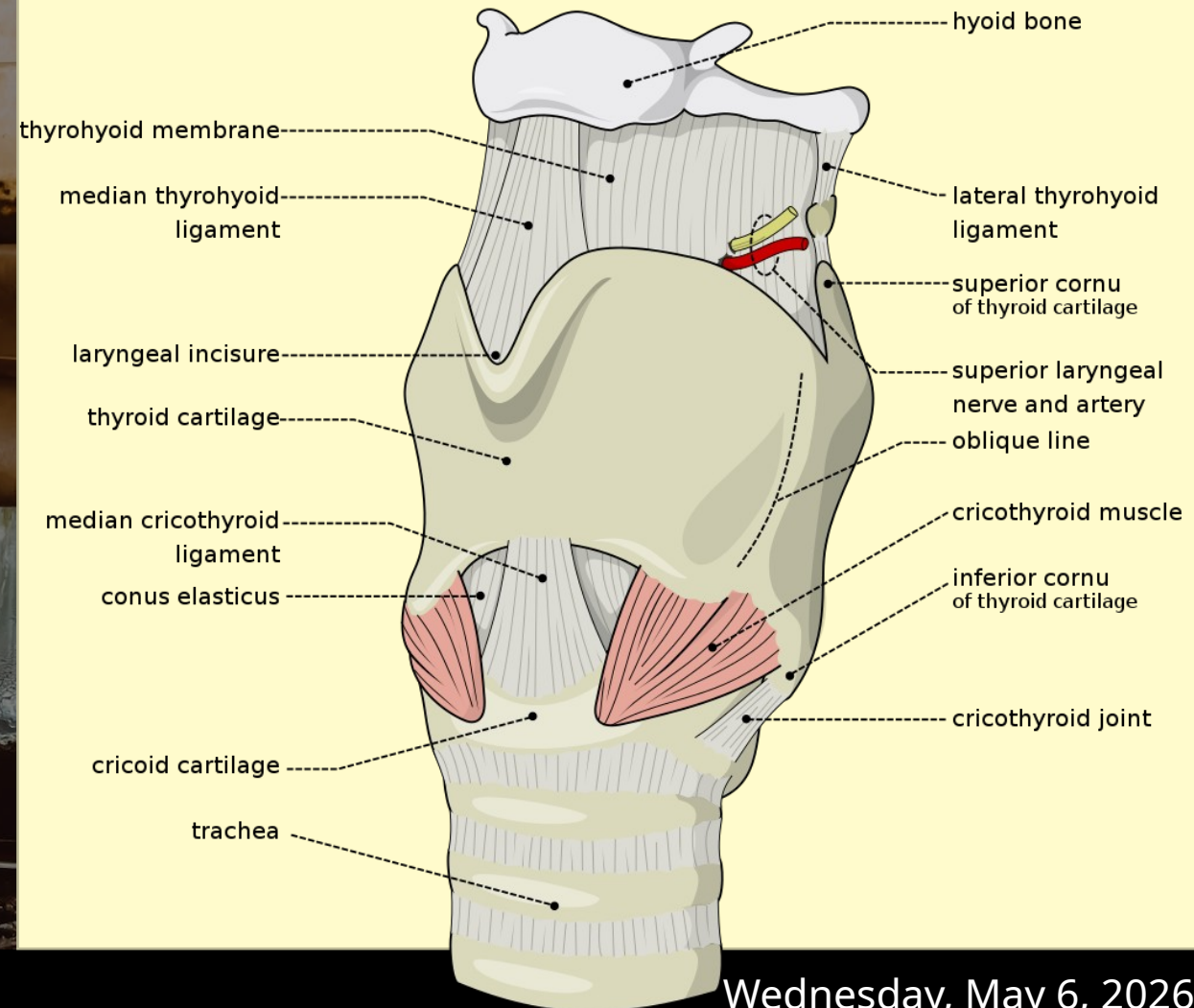
★ **larynx** ( 喉頭 )

layman's term: voice box

### 喉頭



甲状軟骨		無対	喉頭隆起 (のど仏) を形成
輪状軟骨	硝子軟骨	無対	食道狭窄部 (輪状軟骨狭窄部) を形成 第6頸椎の高さ
披裂軟骨		有対	声帯の緊張度を変え、発声に関与
喉頭蓋軟骨	弾性軟骨	無対	食べ物か喉頭内に入るのを防ぐ



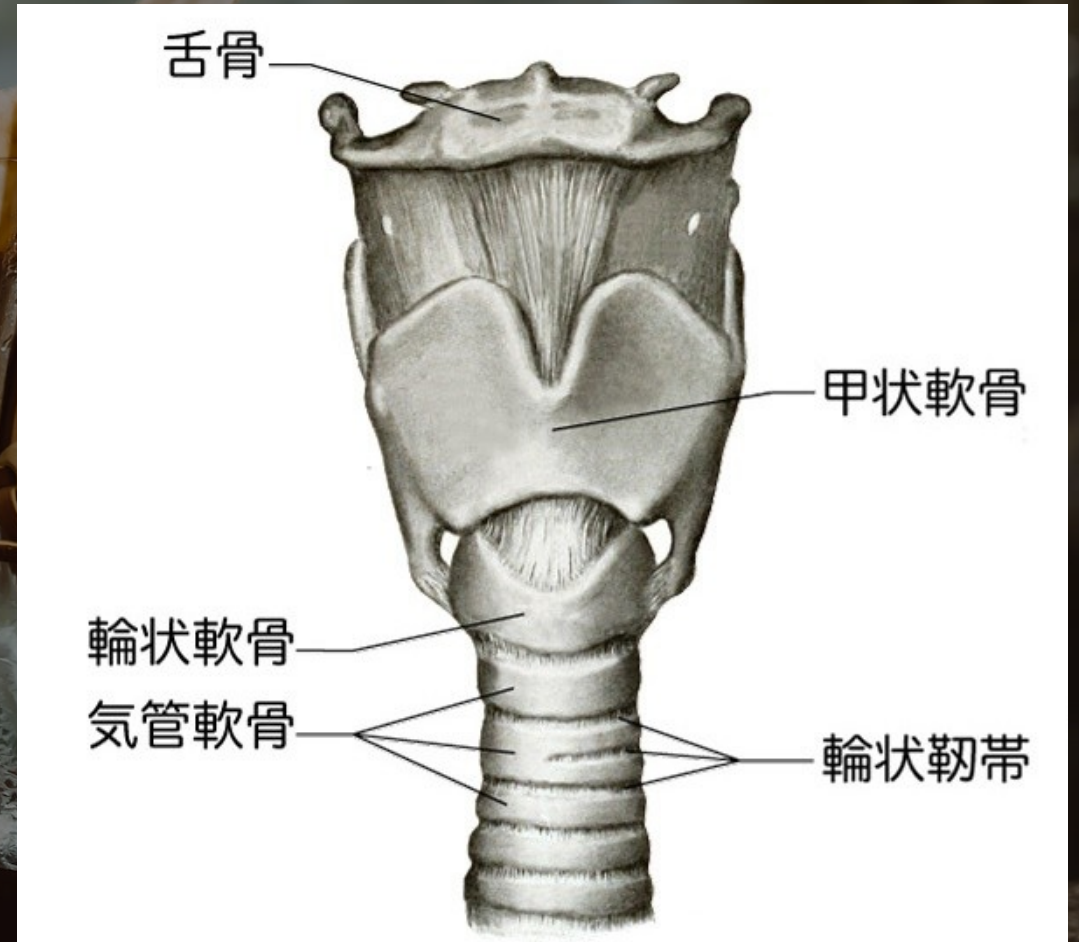
# Lecture: The Source-Filter Model

## Boney bits

- ★ **hyoid bone** ( 舌骨 )  
only bone in humans that is not connected to any other nearby bones

- ★ **thyroid cartilage** ( 甲状软骨 )  
larger, higher of the two cartilages  
laryngeal prominence ( 喉頭隆起 ) in front  
grows due to testosterone during puberty  
layman's term: Adam's apple ( 喉仏 )

- ★ **cricoid cartilage** ( 輪状软骨 )  
smaller, lower of the two cartilages

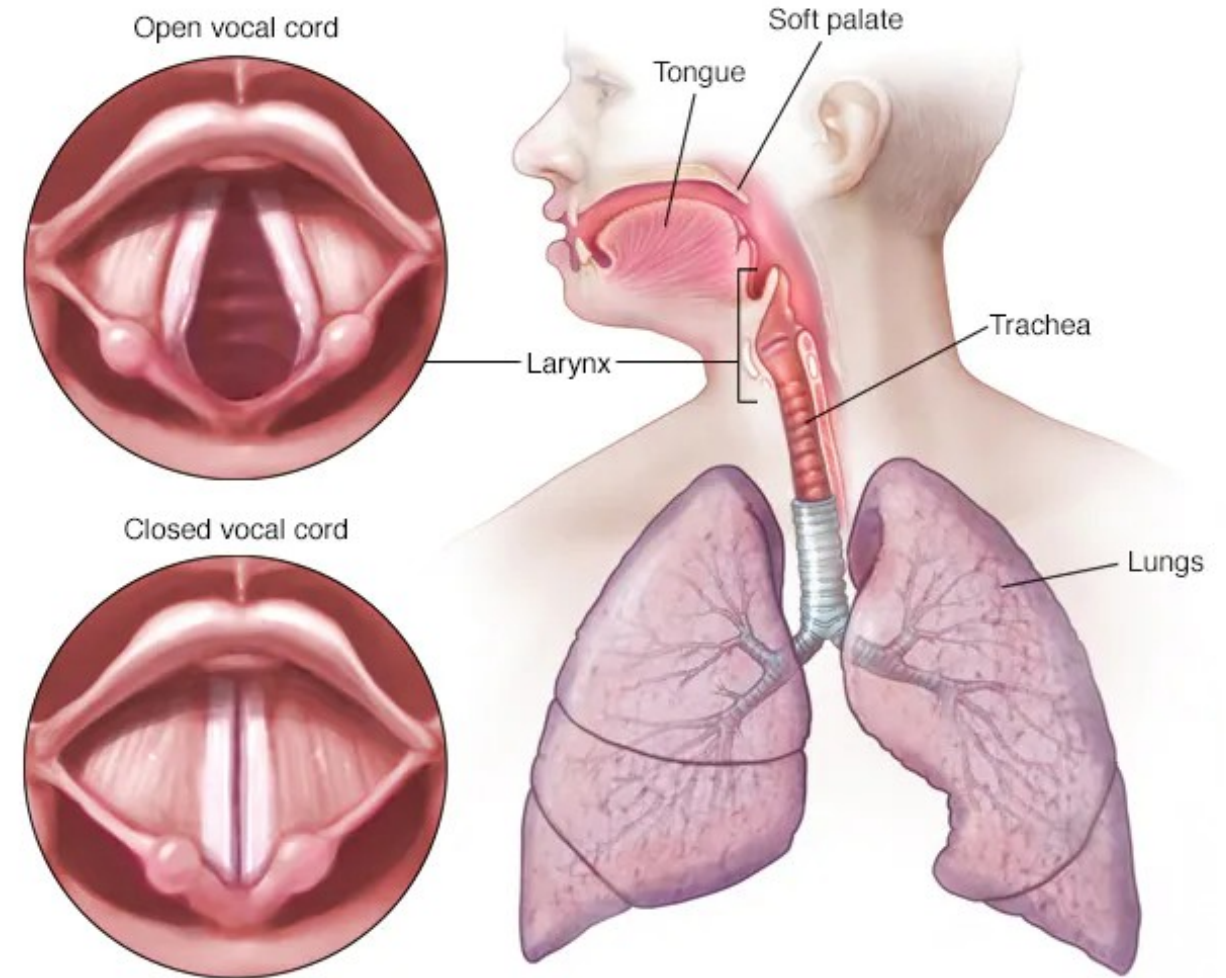
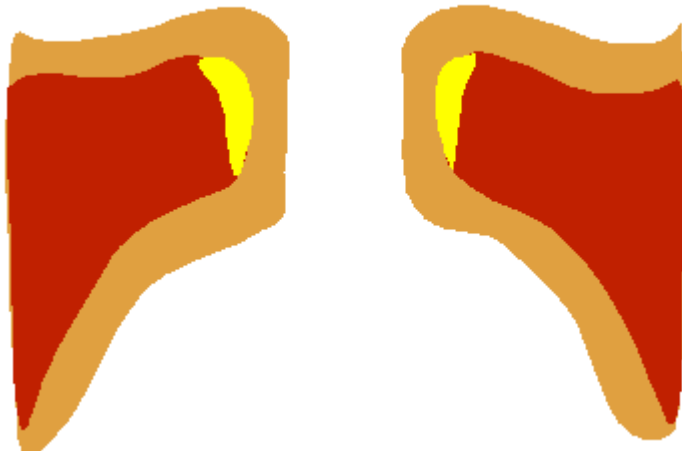


# Lecture: The Source-Filter Model

## The main characters

★ **vocal folds** ( 声帯 )  
せいたい  
layman's term: vocal cords  
thicker, longer, rounder in men

★ **glottis** ( 声門 )  
せいもん  
space between vocal folds

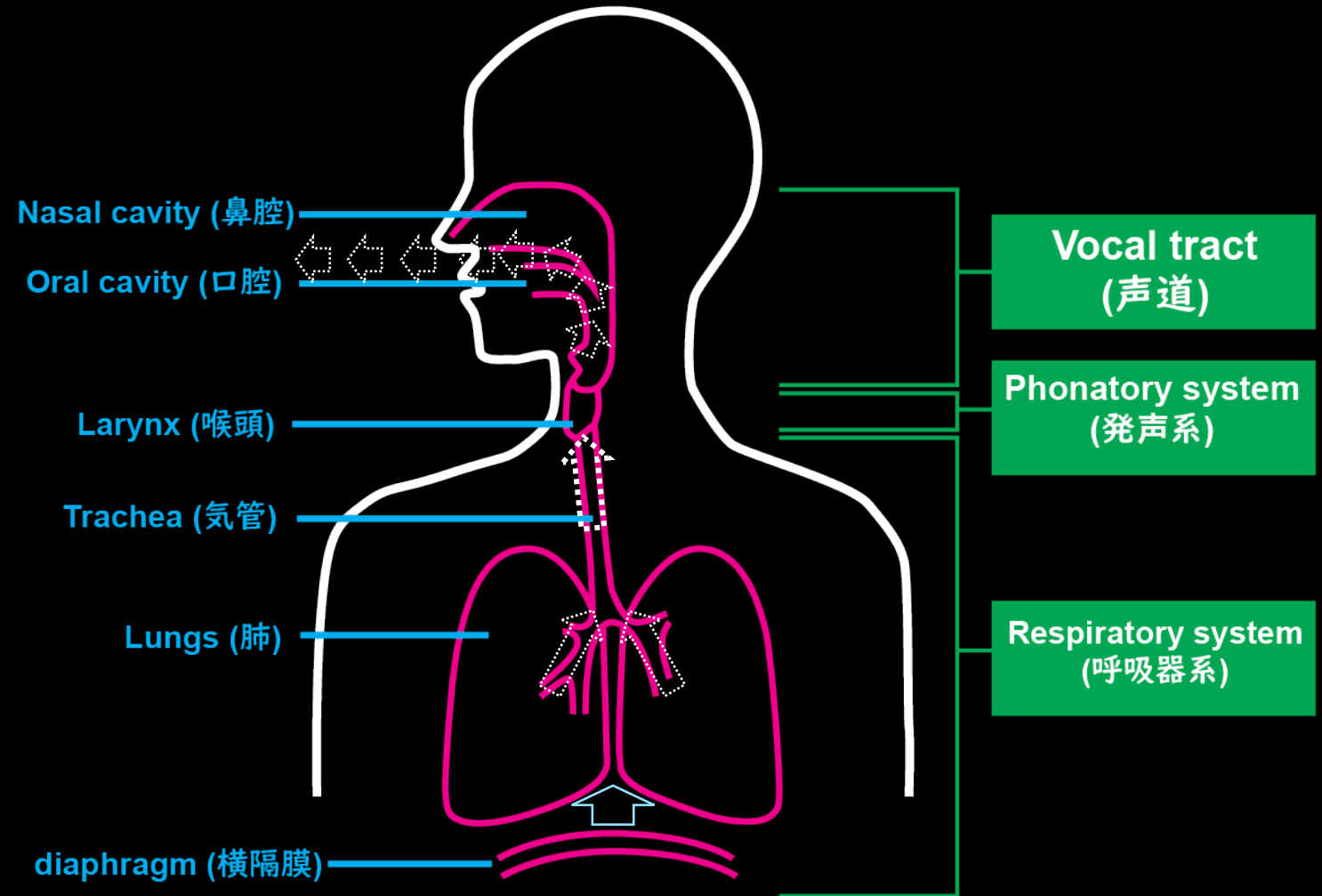
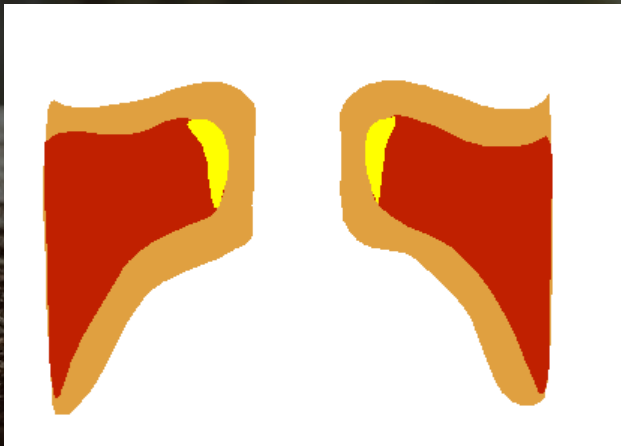


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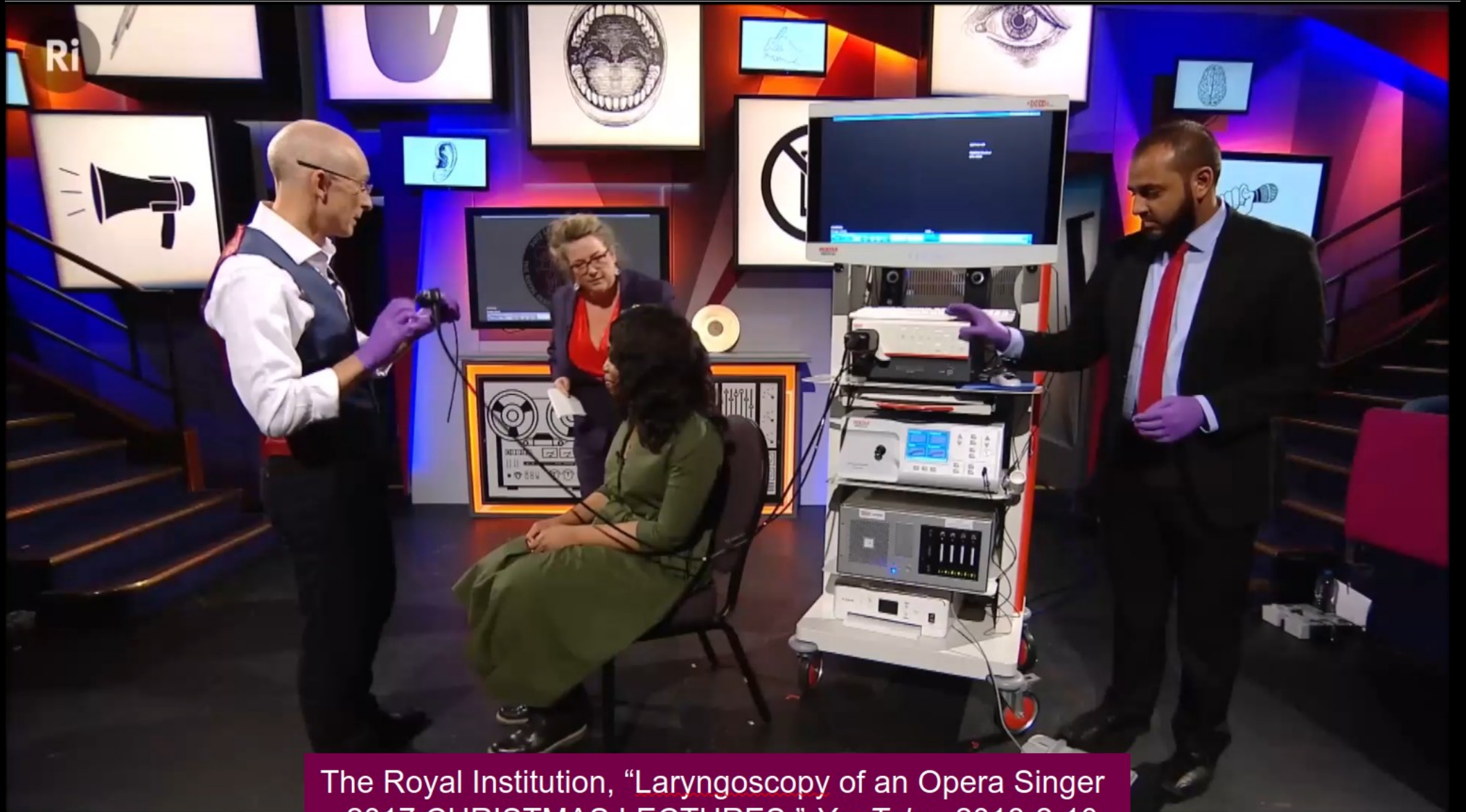
# Lecture: The Source-Filter Model

## The process of phonation ( 発声 )

- ★ Diaphragm pushes air up through trachea
- ★ Closed vocal folds are pushed open, then fall back together many times per second
- ★ This adds vibration to the air, making a voice

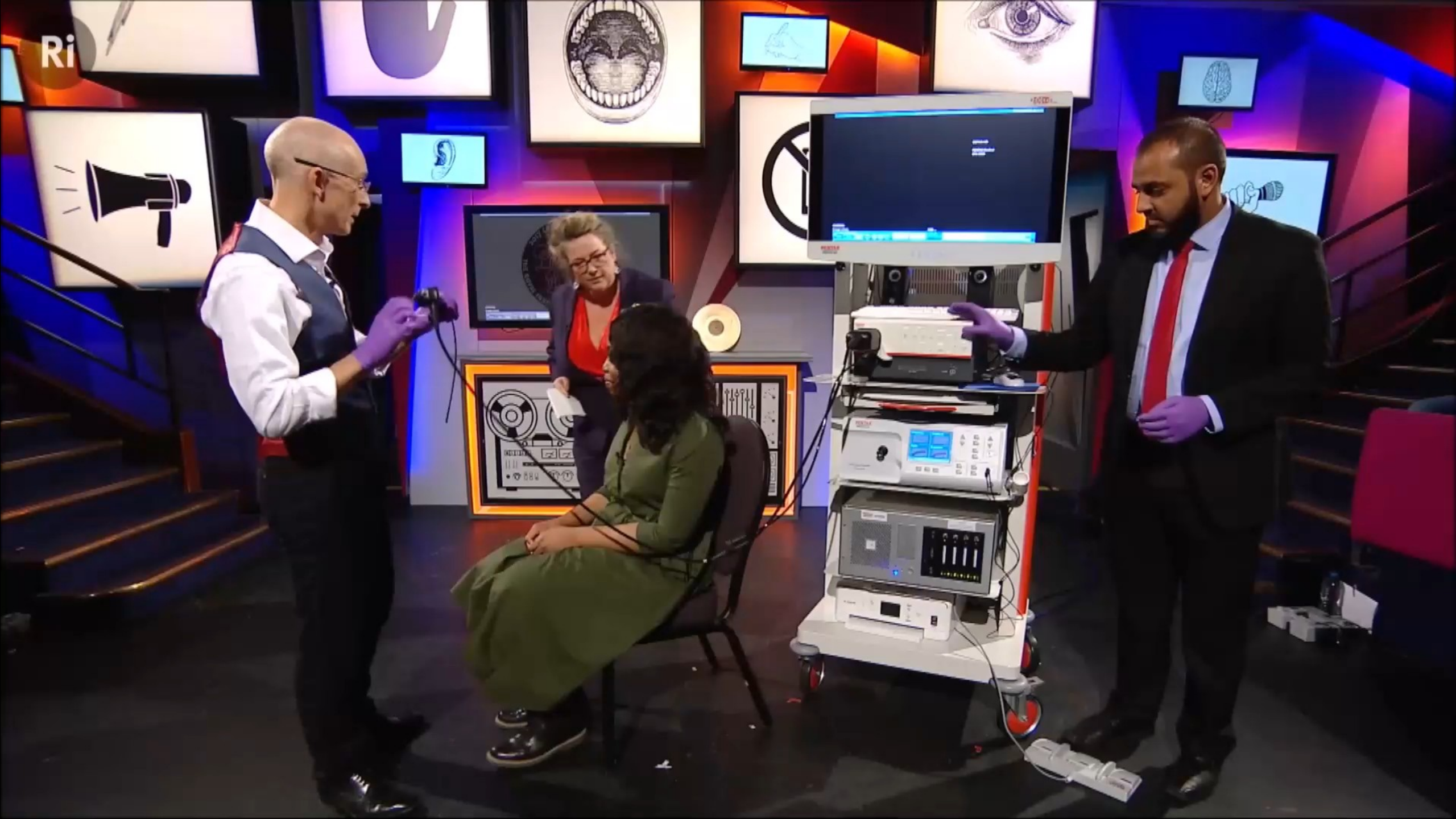


# Lecture: The Source-Filter Model



The Royal Institution, "Laryngoscopy of an Opera Singer – 2017 CHRISTMAS LECTURES," *YouTube*, 2018-2-10

Ri



# Lecture: The Source-Filter Model

The number of oscillations (振動) of the vocal folds each second is the fundamental frequency. (基本周波数)



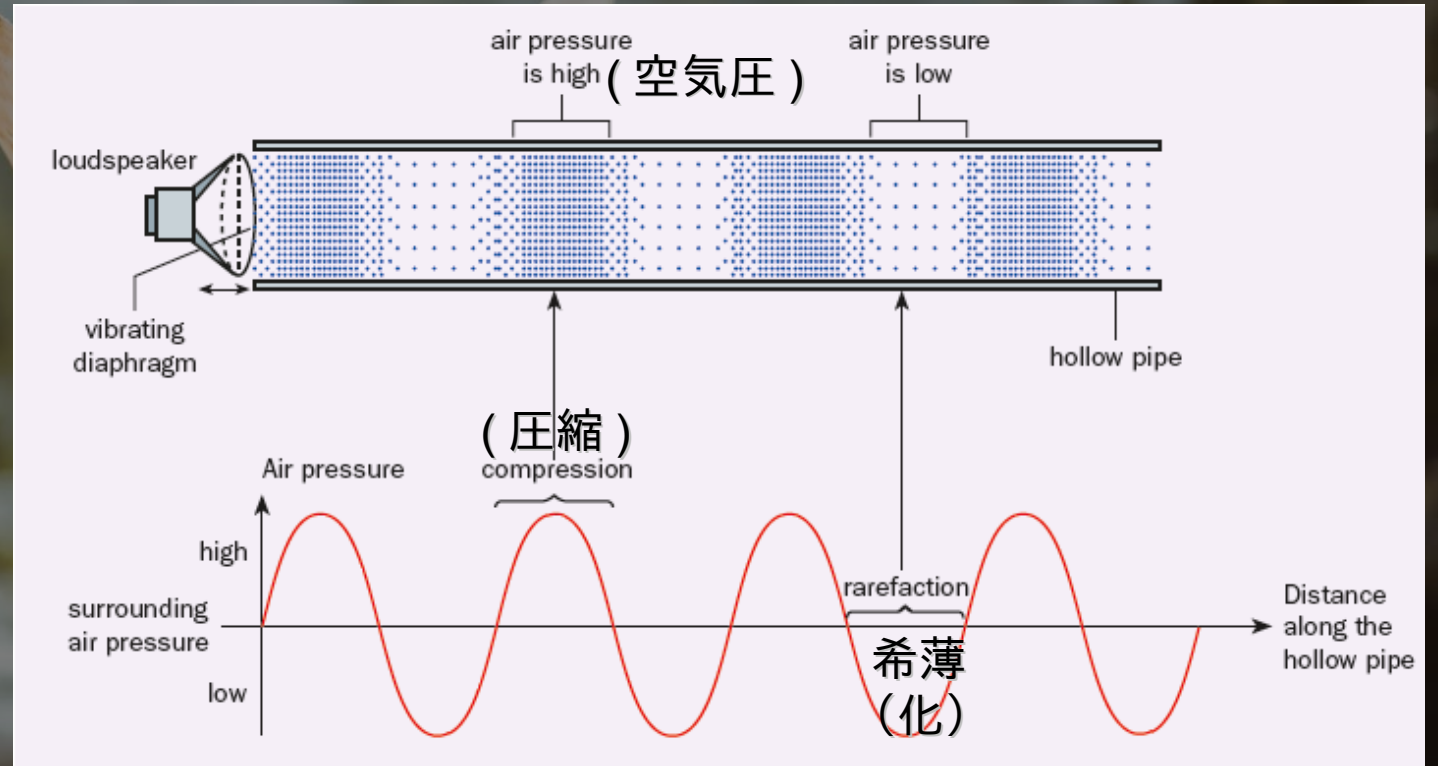
	range	average
child	208~440Hz	265Hz
woman	155~334Hz	225Hz
man	85~196Hz	128Hz

Howard, D.M. (1998) 'Instrumental voice measurement: uses and limitations' in Harris, T., Harris, S. Rubins, J.S. and Howard, D.M. (eds) *The Voice Clinic Handbook* London: Whurr.  
Mathieson, L. (2001) *Greene and Mathieson's The Voice and Its Disorders (6th edn)* London: Whurr Publishers.

# Lecture: The Source-Filter Model

## What is sound?

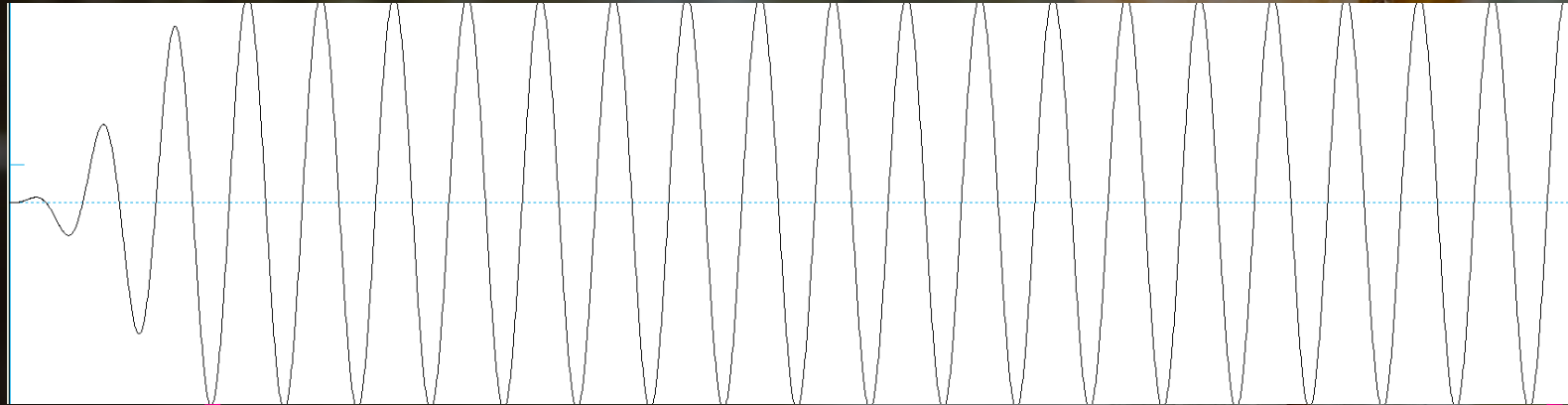
- ★ Waves of high and low air pressure
- ★ The vocal folds directly create periods of high and low pressure
- ★ Sound does not travel in wiggly lines!



# Lecture: The Source-Filter Model

## Waveforms ( 波形 )

- ★ This is a pure tone ( 純音 ), like a sin wave
- ★ This is periodic ( 周期的 )
- ★ Noise is non-periodic ( 非周期的 )



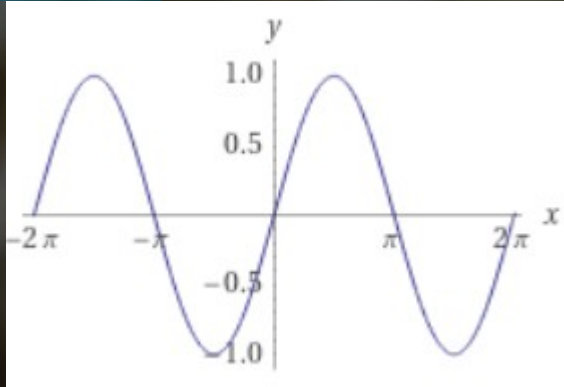
Amplitude ( 振幅 )  
measured in  
decibels (dB)

Frequency ( 周波数 )  
measured in Hertz (Hz)  
1 Hz = 1 wave/second

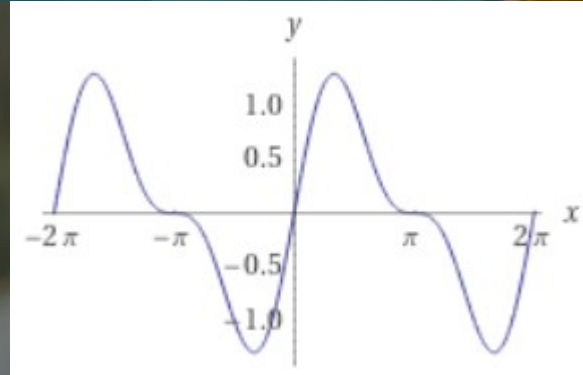
# Lecture: The Source-Filter Model

Two or more pure tones together make a complex tone (複合音)

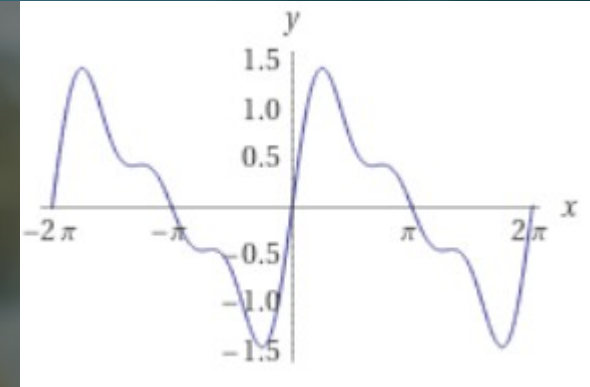
$$y = \sin(x)$$



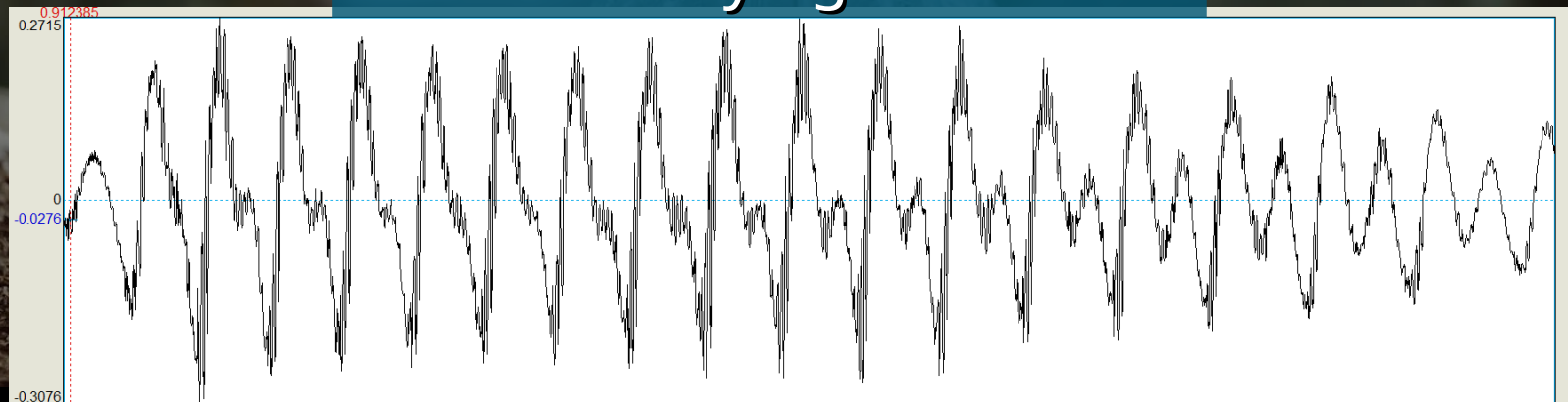
$$y = \sin(x) + \frac{1}{2}\sin(2x)$$



$$y = \sin(x) + \frac{1}{2}\sin(2x) + \frac{1}{3}\sin(3x)$$



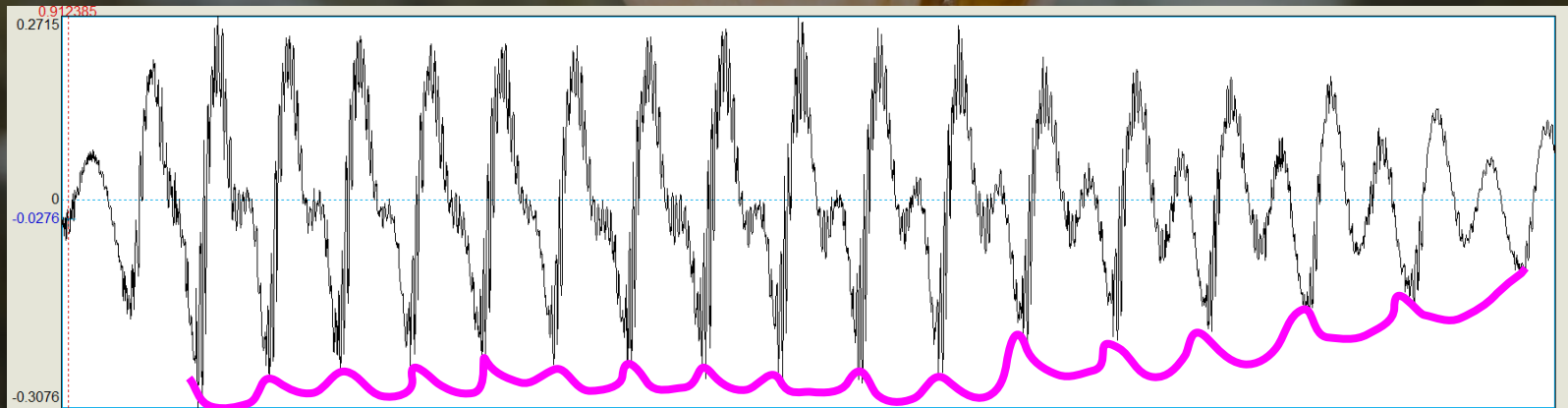
me saying "iiii"



# Lecture: The Source-Filter Model

## Fundamental frequency ( 基本周波数 )

- ★ The largest on the graph
- ★ We hear this as pitch



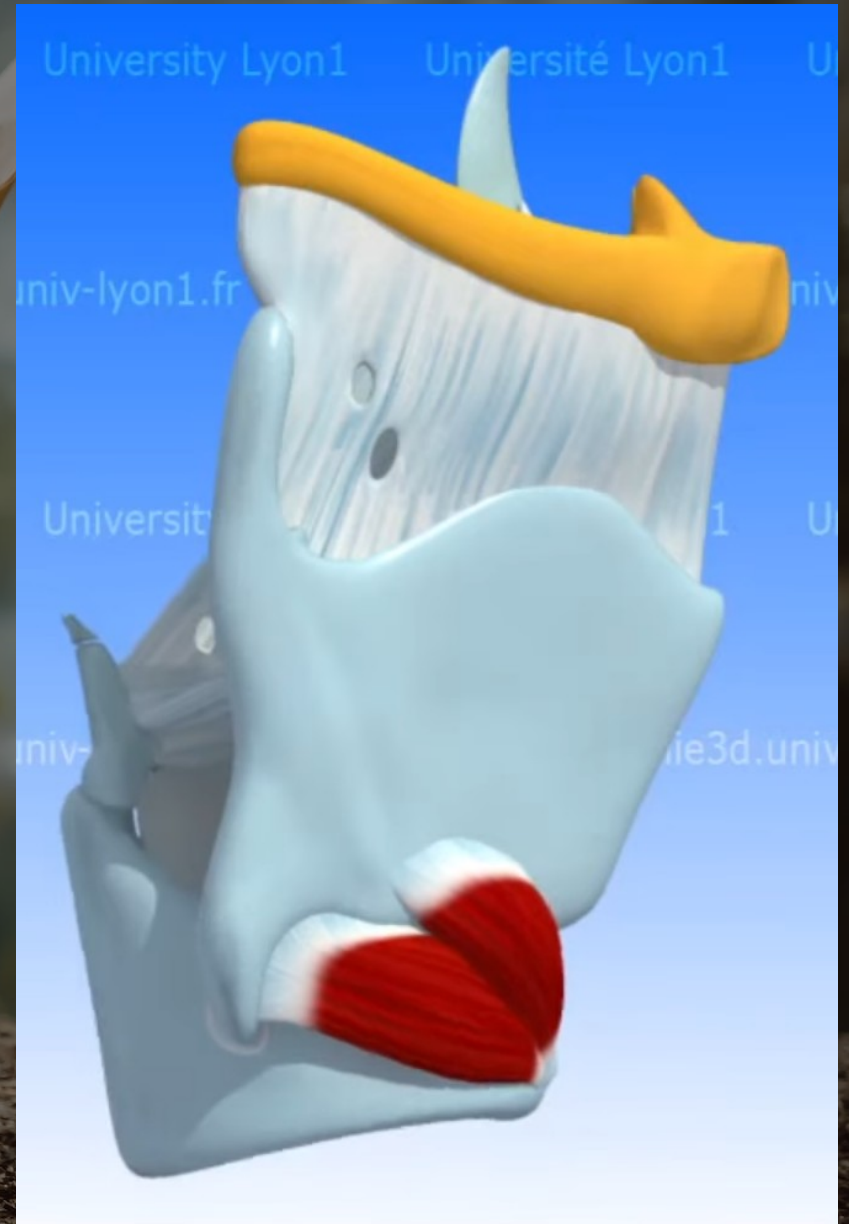
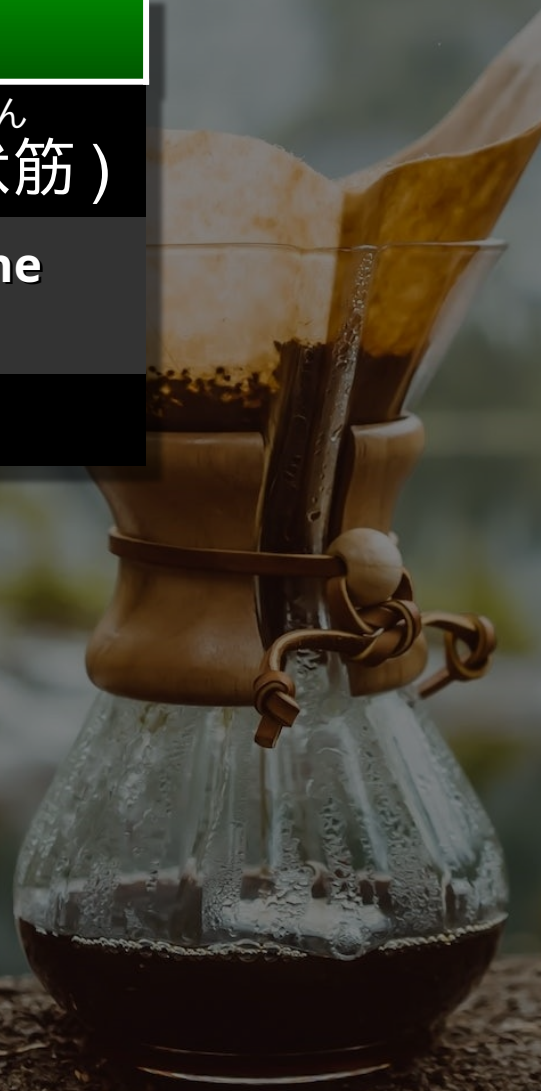
# Lecture: The Source-Filter Model

## Changing pitch

★ **cricothyroid muscle** ( 輪状甲状筋 )  
りんじょうこうじょうきん

★ Tilts the thyroid cartilage to stretch the vocal folds

★ Pitch goes higher under tension



# Lecture: The Source-Filter Model

Let's try singing!

- Hold your fingers up to your throat. Feel the two cartilages. Feel how they change position, up and down, forward and back.



♪ ~ 上を向いて歩こう ~ ♪

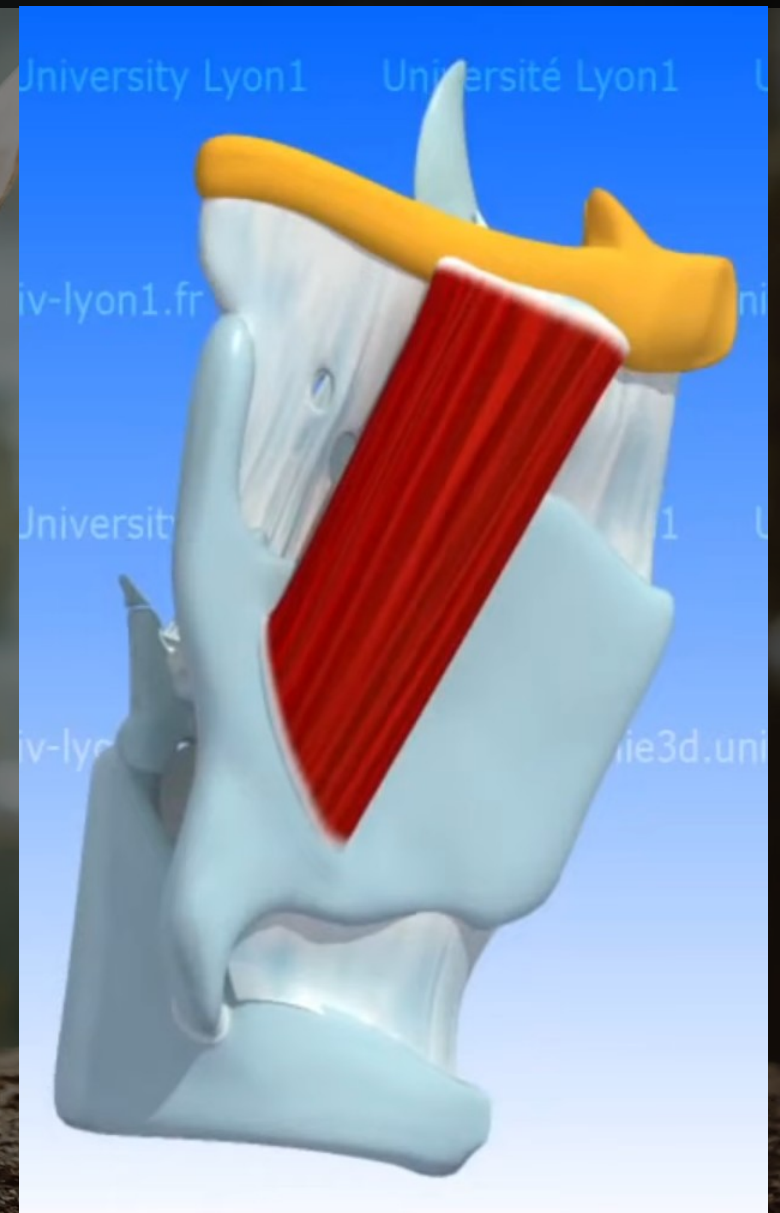
♪ ~ Let it go, let it go  
Can't hold back anymore ~ ♪



# Lecture: The Source-Filter Model

## Operatic tone

- ★ **thyrohyoid muscle** ( 甲状舌骨筋 )  
こうじょうぜっこつきん
- ★ attaches to the thyroid cartilage ( 甲状軟骨 )  
and the hyoid bone ( 舌骨 )
- ★ moves the larynx up and down
- ★ makes a larger resonating chamber ( 反響室 )



Juan Diego Flórez & Diana Damrau, "Libiamo, ne' lieti calici,"  
*La Traviata*, Giuseppe Verdi. Metropolitan Opera, 2018-12-18.



# Lecture: The Source-Filter Model

Let's try singing!

- Try to lower your larynx. Your voice will get larger and fuller, but the pitch should stay the same.

♪ ~ 上を向いて歩こう ~ ♪

♪ ~ **Let it go, let it go**  
**Can't hold back anymore** ~ ♪



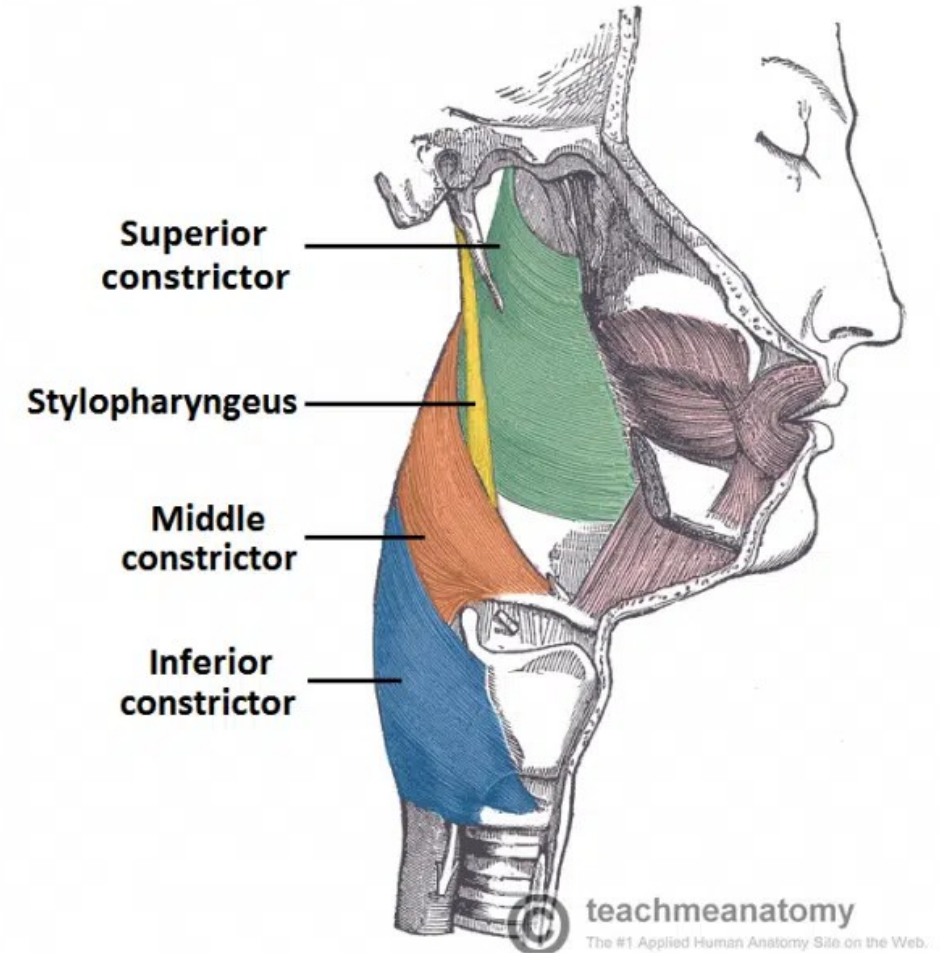
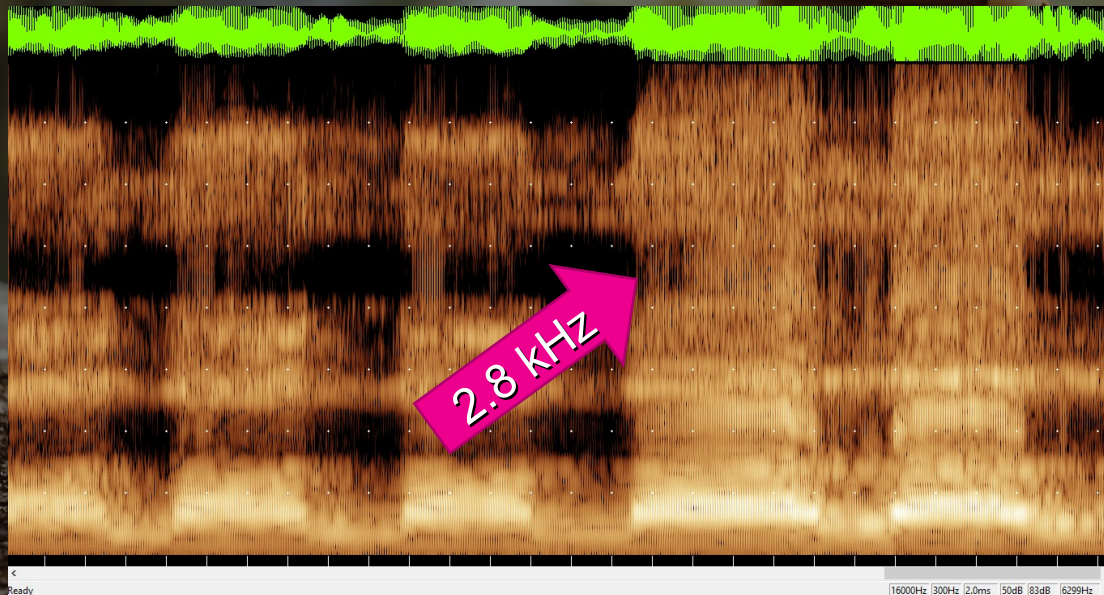
# Lecture: The Source-Filter Model

## Pop and rock singing: "twang"

★ **pharyngeal constrictor muscles** ( 咽頭収縮筋 ) いんとうしゅうしゅくきん

★ surround the **pharynx** ( 咽頭 )

★ tighten and harden the throat, reducing damping from soft tissues (especially around 2.8 kHz)





Chaka Khan, "I'm Every Woman," 1978.

# 講義：発声 (phonation)

Let's twang!

- Service workers use it all the time!



いらっしやいませ!

Welcome to Burger King, home  
of the Whopper!



# Lecture: The Source-Filter Model

Let's try singing!

- Use the 「いらっしやいませ」 voice! Tighten your pharynx (咽頭), tilt your larynx (喉頭) forward, and close your vocal folds fully.



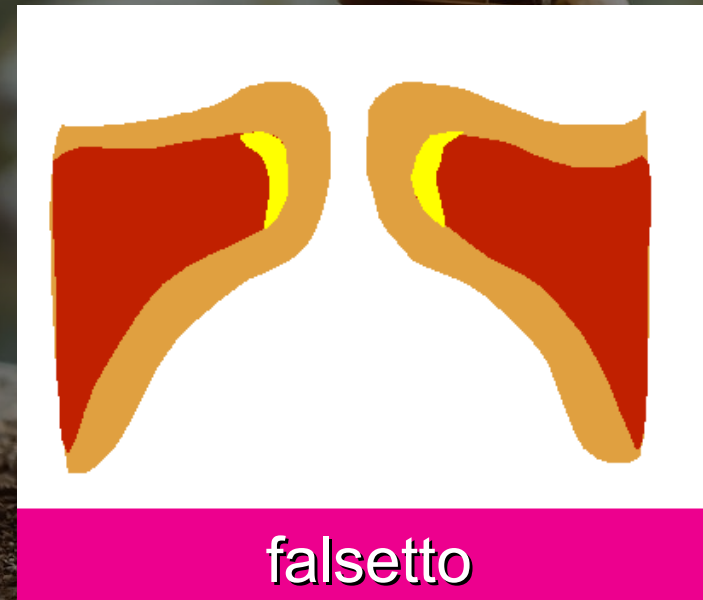
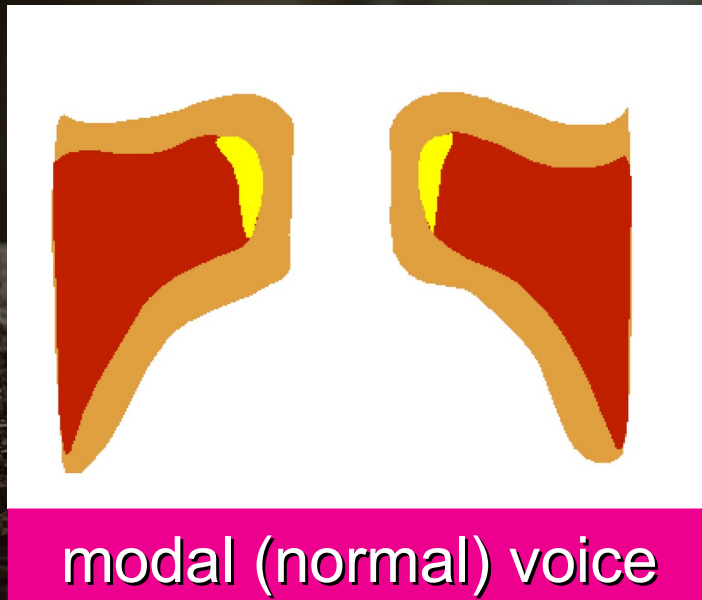
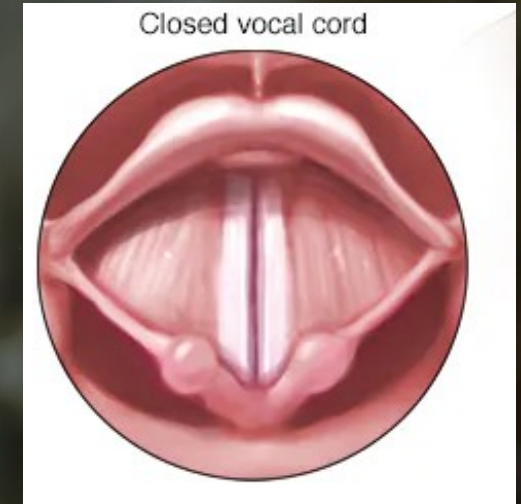
♪ ~ 上を向いて歩こう ~ ♪

♪ ~ Let it go, let it go  
Can't hold back anymore ~ ♪



# Lecture: The Source-Filter Model

Voice registers ( 声区 )		
	English	Japanese
Highest	<b>whistle register, flageolet</b>	フラジオレット
↕	<b>falsetto</b>	ファルセット、仮声
	<b>modal voice</b>	地声
Lowest	<b>creaky voice, vocal fry</b>	きしみ声



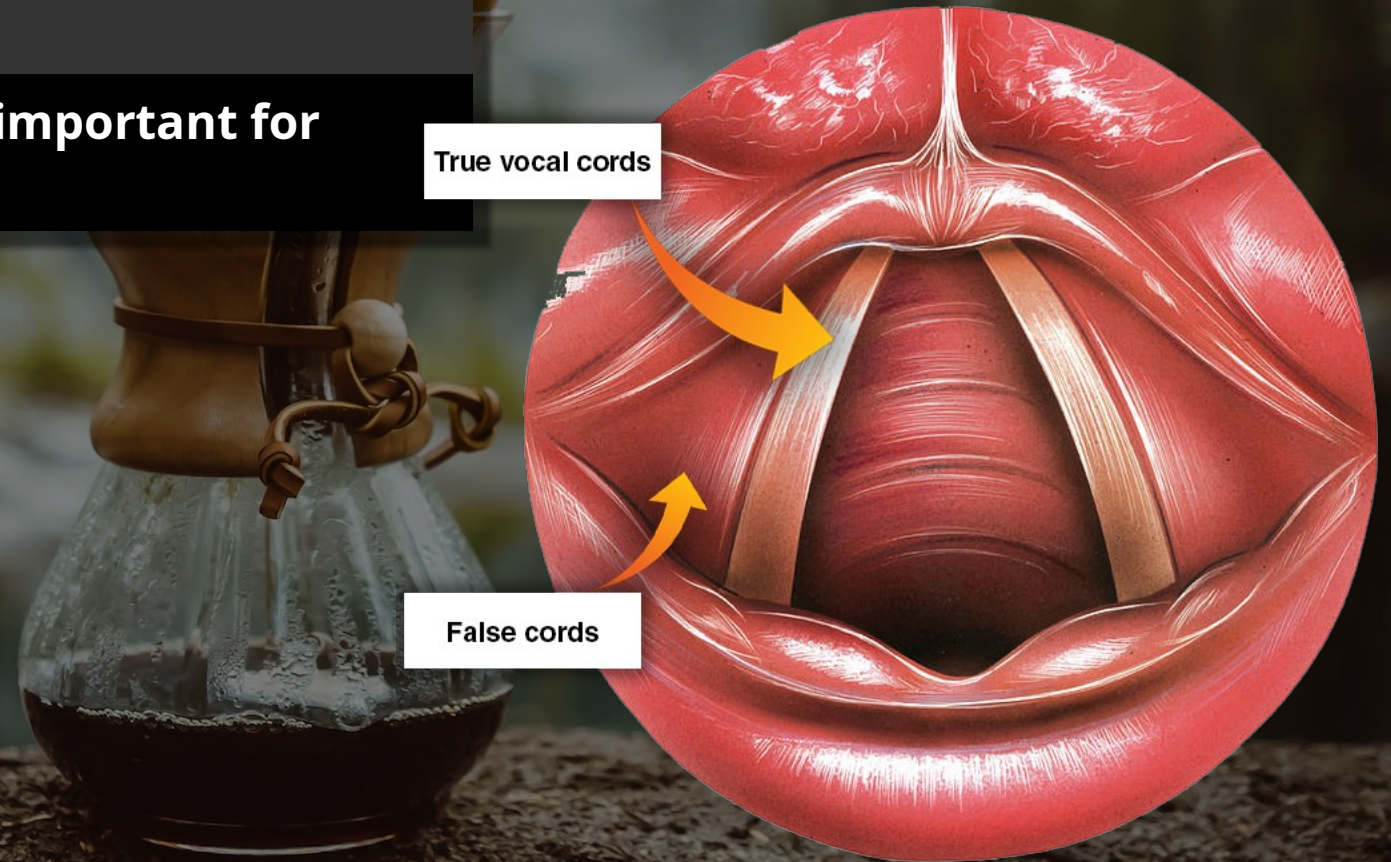
Mariah Carey, "Emotions," *Live*  
at *MTV Unplugged*, March 1992



# Lecture: The Source-Filter Model

## Weirder voices

- ★ **false vocal folds** ( かせいたい 仮声帯 )
- ★ **meaty part outside the vocal folds**
- ★ **not usually used in speech, but very important for metal**





Adrienne Cowan, "Easy and Safe Metal Screaming Tutorial (Beginner Level)", *YouTube*, 2021-2-20, <https://www.youtube.com/watch?v=Qv5t2ITnW1s>

# Lecture: The Source-Filter Model

## Let's try screaming!

- Make a big, annoyed sigh. Give it breath support. Open your jaw wide.

上を向いて歩こう

Let it go, let it go!



# This week's reading



# This week's reading

有本ら（2021）「英語発音の指導：基礎知識からわかりやすい指導法・使いやすい矯正方法まで」三修社

★ 27~34

# Thanks for coming!



## Homework

★ Read Arimoto et al, 27~34

## Next week

Pronunciation

Consonant clusters

Lecture

English rhythm

Game

Blooket